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## **Lead poisoning: the epidemic hitting the US juvenile justice system**

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**Abstract:** Not all behavioural issues that lead to juvenile delinquency are hereditary. In fact, there are behavioural issues that can be prevented, such as lead poisoning, that affect the likelihood of juvenile delinquency. This article focuses on the relationship between elevated juvenile lead exposures leading to lead poisoning, specifically its effects on a child's body, and juvenile delinquency. The author explains how only a small amount of lead is needed to elevate lead levels in juveniles, including a discussion of several nationwide reports conducted to inform the public of this once trending epidemic and since its known existence, whether there have been sufficient changes to drastically lower levels amongst families. The article concludes with a public service message of ways to prevent lead poisoning in one's home.

**Keywords:** juvenile delinquency; lead poisoning; lead exposure; behavioural issues; juvenile crime.

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### **1 What is lead poisoning?**

Lead poisoning results from high exposure to lead and its subsequent absorption in the body. Since lead poisoning results from lead exposure, it is one of the most common preventable poisonings of childhood diseases. Data from the US Centre for Disease Control (CDC) shows that 6% of all children ages one to two years and 11% of African-American (non-Hispanic) children ages one to five years have blood lead levels in the toxic range in the area a lead poisoning (American Academy of Child and Adolescent Psychology, [http://www.aacap.org/cs/root/facts\\_for\\_families/lead\\_exposure\\_in\\_children\\_affects\\_brain\\_and\\_behavior](http://www.aacap.org/cs/root/facts_for_families/lead_exposure_in_children_affects_brain_and_behavior)). Very small amounts of lead are associated with toxicity. There have been discrepancies amongst researchers in determining the levels indicating lead poisoning. Thus, it has been reported that levels as low as 10 µg/dL shows

enough lead exposure to diagnose lead poisoning. Other studies indicated higher numbers later concluding that the  $\mu\text{g}/\text{dL}$  would actually be lower. This could simply be the result of more in-depth research over time. For example, one study indicated that lead poisoning was not diagnosed until blood levels reached as high as 45  $\mu\text{g}/\text{dL}$ . Lead is a hazardous element, which in the past was commonly found in general materials and products, including paints on children's toys until it was known to negatively impact child development and later, child behaviour.

In a research report analysing the effects of lead poisoning, it was indicated that some common sources of lead include: water, paint, electric storage batteries, insecticides, auto body shops, and gasoline (Patel, 2000). "The largest source of lead was paint manufactured before 1978 and the dust created when it decays" (Illinois Department of Health, <http://www.idph.state.il.us/public/hb/hblead.htm>). Because lead based dust is typically in the proximity of the floor where children, and particularly crawling babies usually are placed, and since children constantly touch objects and put their fingers in their mouths, exposure to lead can easily result in commonly high dosages. Another equally common way of being exposed to lead poisoning is through drinking water (BBC News World Edition: Health, <http://news.bbc.co.uk/2/hi/health/2632261.stm>). This lead contaminated water is passed through a number of old lead piping which are common in many older homes. Lastly, a major source of lead exposure is the inhalation of vehicle fumes. The fumes released by the many exhaust systems are a contributing factor in lead poisoning. Generally lead exposure is typically by intake through the mouth and casually breathed in the form of the decayed paint dust.

## **2 What is the relationship between lead poisoning and juvenile delinquency?**

There are a number of studies that have been conducted to determine if lead poisoning amongst juveniles have an effect on juvenile delinquency. Most of these studies have concluded that there is some correlation between elevated blood levels of lead and juvenile delinquency. Scientists have found that even low levels of lead poisoning have been a contributing factor for some, not all, cases of juvenile delinquency (id). "A study of young offenders passing through a court in Pennsylvania found that on average, concentrations of lead in bone were much higher than those from non-delinquent teenagers" (id).

Although these results are not definitive in determining that lead poisoning, even at low levels, is for sure a contributing factor, scientists are certain that "high levels of lead poisoning are toxic, particularly to brain development in children" (id). It has long been established that high levels of lead poisoning are toxic, particularly to brain development in children (id). This exposure tends to have harmful side effects on the nervous system (brain) and the urinary system (kidneys), where the lead can be stored for many years. The effects of high lead exposure amongst children can result in "learning disabilities, mental retardation, behavioural problems, lowered intelligence, stunted growth, and hearing impairment. Some recent studies claim that childhood lead poisoning can contribute to problems later in life, such as academic failure, juvenile delinquency, and high blood pressure" (id).

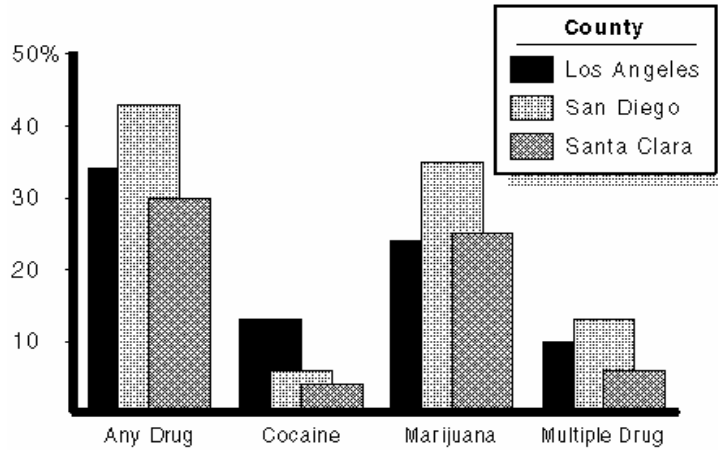
Published research shows that lead exposure and criminality is linked to evidence of poorer intelligence, low communication skills, and behavioural problems, such as

vandalism and bullying (Norton, 2000). Another study conducted by the Allegheny County Juvenile Court in Pennsylvania found delinquent juveniles were four times more likely to have elevated concentrations of lead in their bones than non-delinquent juveniles (Talkleft.com, <http://www.talkleft.com/story/2003/01/08/214/26722>). It has been found that children exposed to high lead concentrations later in their adolescent years, experience anti-social behaviour, lower IQ and attention span, learning disabilities, and stunted growth as compared to children who were only exposed to lead in their early youth. Perhaps this is because the earlier in life the exposure and the sooner the exposure ends, the more time the body has to rid itself of the toxin and resume normal function. Many of these effects are displayed in the classroom and lead to juvenile delinquency. Juveniles that have highly prevalent to severe behavioural problems due to lead poisoning or exposure are characterised as having Pb (lead) encephalopathy (Wisconsin Council on Children and Families, [http://wccf.org/pdf/lead\\_delinquency\\_brief.pdf](http://wccf.org/pdf/lead_delinquency_brief.pdf)).

Another study conducted by the Wisconsin Department of Health reported that childhood poisoning explained 88% of the variation in the violent crime rate in the USA over several decades, being a powerful predictor of school disciplinary problems, delinquency and adult criminality (id). These juveniles suffering lead poisoning usually tend to experience antisocial behaviour along with other behavioural problems such as aggression and hyperactivity. Also, it has been concluded that several of the juvenile delinquents, who have been exposed to lead, have consistently used marijuana.

In an Ohio study conducted by the University of Medicine and Dentistry of New Jersey, consisting of 195 newborns, the researchers followed the test group until the ages of 15 to 17, while observing lead exposure and delinquency to determine correlation. The participants were 92% African-Americans and equally divided between males and females. The study concluded that around the age of six, parents of children exposed to lead found that their children did show strong signs of delinquent behaviour with signs of increased aggression and violent behaviour. This was prevalent in both the boys and girls. At the end of the study, it was common amongst the juveniles that if the investigators found that their blood lead levels increased, juvenile delinquency was much more frequent and the individuals were more inclined to use marijuana (University of Medicine and Dentistry of New Jersey, New Jersey Medical School, [http://njms2.umdnj.edu/hwmedweb/archives/LeadDelinq\\_archive.htm](http://njms2.umdnj.edu/hwmedweb/archives/LeadDelinq_archive.htm)). Specifically, three of California's major metropolitan areas found after compiling reported information from the National Institute of Justice that juvenile delinquents are prone to using marijuana and other drugs (see Figure 1).

In the Allegheny County Juvenile Court study, the goal was to find a link between lead exposure and juvenile delinquency. In the study, researchers focused on 194 convicted juveniles who had passed through the Allegheny County Juvenile Court system and 146 high school students who did not have a criminal background and did not have behavioural issues and problems. The test group consisted of youths between 12 and 18 years of age. Lead levels were gathered by scanning each child's leg to get an accurate reading of the lead exposure levels in their bodies. This study considered race, parent education and occupations, single-parent households, number of children in home and neighbourhood crime rate. "The mean concentration of lead in the convicted youths was 11.0 parts per million, compared to only 1.5 parts per million among other high school youths. Based on their findings, researchers attribute an estimated 11 percent to 38 percent of juvenile delinquency in Allegheny County to lead exposure".<sup>1</sup>

**Figure 1** Many Juveniles arrested for an offense also test positive for drugs

Source: National Institute of Justice (1993)

In addition, Preschool blood lead levels were associated with subsequent *crime rate trends* over several decades in the USA, Britain, Canada, France, Australia, Finland, Italy, West Germany and New Zealand (Minneapolis Department of Health and Family Support, 2008). Finally, a prospective study of 250 individuals 19 to 24 years of age demonstrates an association between developmental exposure to lead and adult criminal behaviour. Blood lead levels were measured during pregnancy and until the children were 6.5 years old. Prenatal and postnatal blood lead concentrations are associated with higher rates of *total arrests and arrests for offenses involving violence*. For every 5 µg/dL increase in blood lead level at six years of age, the risk of being arrested for a violent crime as a young adult increases by 50% (id).

### 3 How should society respond to the correlation between lead and delinquency?

#### 3.1 Are there any symptoms to detect lead poisoning?

Lead poisoning has a progressive effect over time and its symptoms are those experienced by most people, such as headaches and abdominal pain. Because these symptoms are so common, this allows detection to go unnoticed. However, a blood test can be administered to detect if there are high levels of lead in the body.<sup>2</sup>

#### 3.2 Who is at risk for lead poisoning and how does it affect juveniles?

When it comes to identifying groups more prone to the risks of lead poisoning, children between the ages of one and six are identifiable perhaps because it is during those years when they are constantly putting their hands and several objects, which may be contaminated with dirt in their mouths. It is when children's growing bodies are sensitive

and can easily absorb lead, which can cause brain and nervous system damage (Product Safety Certification Organization, [http://www.safetyathome.com/environmental-safety/environmental-safety-articles/lead-poisoning-get-the-facts-about-the-threat/?gclid=CNSMgr-imrICFWRntgodhWUA\\_A](http://www.safetyathome.com/environmental-safety/environmental-safety-articles/lead-poisoning-get-the-facts-about-the-threat/?gclid=CNSMgr-imrICFWRntgodhWUA_A)). Other identifiable groups are those considered to be low-income families, which results in more on the population being of African-Americans and Mexican-Americans living in large metropolitan areas. These affected families usually live in older housing built before 1978. The core of these identifiable groups is race. It is among these common races where there is an economic disadvantage and thus being able to afford newer housing is not an option. Further, their lack of being educated on lead exposure and its effects causes them to remain trapped in lead exposed homes. Therefore, if not detected early, children with high levels of lead in their bodies can suffer from such disorders as damage to the brain and nervous system, behaviour and learning problems along with poor attention span, slowed growth, hearing problems, headaches, anaemia, seizures, irritability, abdominal pain, vomiting, weight loss, hyperactivity (id).

### *3.3 What are the risk factors identified with juvenile crimes?*

Parents and educators should watch for certain characteristics or factors in juveniles, not only because they may be precursors to criminal behaviour, but because they may signify an underlying lead exposure issue or lead poisoning.

#### *3.3.1 Failure in school*

This factor manifests itself at an early age. Failure at school includes poor academic performance, poor attendance, or more likely, expulsion or withdrawing from school. This is an important factor for predicting future criminal behaviour. Leaving school early reduces the chances that juveniles will develop the 'social' skills that are gained in school, such as learning to meet deadlines, following instructions, and being able to deal constructively with their peers (State of California: Legislative Analyst's Office, [http://www.lao.ca.gov/1995/050195\\_juv\\_crime/kkpart3.aspx](http://www.lao.ca.gov/1995/050195_juv_crime/kkpart3.aspx)). In addition, juvenile who are not in school have more opportunities to interact with unhealthy role models and potentially engage in criminal behaviour.

#### *3.3.2 Family problems*

This factor includes a history of criminal activity in the family. It also includes juveniles who have been subject to sexual or physical abuse, neglect, or abandonment. It is also manifested by a lack of parental control over the child (id).

#### *3.3.3 Substance abuse*

This risk factor includes not just arrests for drug or alcohol possession or sale, but also the effect of substance abuse on juvenile behaviour. For example, using alcohol or drugs lowers a person's inhibitions, making it easier to engage in criminal activity. Also, drug abuse can lead to a variety of property offenses to pay for drug habits (id).

### *3.3.4 Pattern behaviours and 'conduct' problems*

Pattern behaviours include chronic stealing or running away. Juveniles with 'conduct' problems can be characterised as those individuals who have not outgrown aggressiveness by early adolescence (id).

### *3.3.5 Gang membership and gun possession*

Gang membership and gang-related crime is primarily a juvenile problem. Gang membership, especially at an early age, is strongly associated with future criminal activity. Juvenile gun possession is a factor that 'magnifies' juvenile crime by making offenses more likely to result in injury or death (id).

## *3.4 Has there been a decline in reports of lead poisoning and therefore a decline in juvenile delinquency?*

In recent years, there has been a steady decline of lead poisoning reports. As landlords of government subsidised homes are required to inform tenants of lead exposure (US Department of Housing and Urban Development, [http://portal.hud.gov/hudportal/HUD?src=/program\\_offices/healthy\\_homes/enforcement/disclosure](http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/enforcement/disclosure)), it has been quite common that although the paint is not scraped and removed, several landlords have painted over the old paint with new lead-free based paint to reduce exposure (Leadfreekids.org, [http://leadfreekids.org/my\\_home/index.php](http://leadfreekids.org/my_home/index.php)). There are other proactive measures that contributed to this decline as well. From these proactive measures, scientists and researchers have seen blood lead levels decrease and severe/fatal lead levels are almost non-existent. Because of the increased awareness, physicians are more aware of the various symptoms to provide a quicker reaction to those exposed to lead. Although there has been a steep decrease in lead exposure in all children, higher lead concentration levels remain widespread amongst African-American children and poor children (American Academy of Pediatrics, <http://pediatrics.aappublications.org/content/116/4/1036.full>). Suspected factors in contributing to the higher concentrations amongst African-Americans and poorer children could stem from the shortage of affordable housing and the lack of significant increases in minimum wage jobs. In spite of this, there still can be no definitive answer as to whether there has been a decline in juvenile delinquency as a result of the decline in lead poisoning amongst children exposed at an early age. These studies are assumed to continue to eventually bring to a close that lead poisoning does have an effect of juvenile delinquency.

## *3.5 Moving forward*

Knowing there is at least a correlation between lead poisoning amongst children and juvenile delinquency, it is important to continue to educate parents, physicians and teachers the importance of ways to decrease lead exposures to children. Landlords need continue being required to disclose the possibility for their structure to contain lead, but on a more proactive approach, there needs to be more required of them. It should be the law for landlords to repaint all areas, with lead free paint, each time a new tenant moves in. This would decrease the chances of paint drying out, flaking off, and creating dust and paint chips that could have absorbed some of the old lead-based paint. Increased calcium

intake should also be encouraged as part of school and daycare meals and nutritional programmes for low-income families, since researchers have concluded that increased calcium intake helps to prevent lead poisoning.<sup>3</sup>

#### 4 Conclusions

Although lead is common element that can be found in several places such as old paints, soils, old piping, water, and the air, it can cause irreversible damage to the body and its nervous system. The damage can range from simple headaches to death. However, early detection and treatment is important to reduce the risk of damage to children. Early detection and treatment can prevent children from experiencing permanent damage in the long run. Prevention and treatment begins with removing children from environments where they can be exposed to lead. As physicians learn more about this area in the health and sciences, they should be able to provide improved and more effective treatments to safely remove lead from the body.

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### **Notes**

- 1 Talkleft.com, *supra* note 11.
- 2 Wisconsin Council on Children and Families, *supra* note 12.
- 3 University of Medicine and Dentistry of New Jersey, *supra* note 14.